



(11) (C) 1,329,852

(21) 612,217

(22) 1989/09/21

(45) 1994/05/24

(52) 379-4

C.L. CR. 350-11

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(51) INTL.CL. ⁵ H04N-001/32; H04N-001/44; H04N-001/21; H04M-011/00

(19) (CA) **CANADIAN PATENT** (12)

(54) Facsimile Telecommunications System and Method

(72) Gordon, Richard J. , U.S.A.
Kennedy, James R. , U.S.A.

(73) Audiofax, Inc. , U.S.A.

(30) (US) U.S.A. 248,798 1988/09/22

(57) 32 Claims

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Abstract of The Disclosure

A system and method for facilitating facsimile transmissions has one or more store and forward facilities, each associated with a plurality of subscriber facsimile machines, typically coupled over the switched telephone network. The store and forward facilities include a computer for controlling operations and mass data storage equipment. A subscriber to the system delivers an outgoing facsimile message to the store and forward facility with which it is associated, which records the fax message together with data as to originating facsimile machine and destination facsimile machine. The store and forward facility then delivers the facsimile message to the intended receiver facsimile machine, either directly or through another store and forward facility. If unsuccessful on an initial attempt, the store and forward facility periodically retries to send the facsimile message. The system also provides spooling of all facsimile messages for an intended receiver machine, which are all transmitted upon making connection with the receiver machine. Subscriber mailboxes are provided as part of the mass storage, which can be accessed by a subscriber to have his messages delivered to any facsimile machine he designates. Secure facsimile transmission is achieved through use of subscriber PIN numbers. Broadcasting, redirecting messages and cost accounting can also be achieved by the system and method.

CLAIMS

1. A system for facilitating facsimile communications between a transmitting facsimile machine and at least one intended receiving facsimile machine, comprising at least one store and forward facility, means coupling the at least one store and forward facility to the switched telephone network for receiving transmissions from a transmitting facsimile machine, said store and forward facility including computer means for controlling its operation and including mass storage means for storing facsimile transmissions together with information identifying the transmitting facsimile machine and the at least one intended receiving facsimile machine under control of said computer means, said store and forward facility also including means coupling it to the switched telephone network for transmitting facsimile messages stored in the mass storage means to at least one intended receiving facsimile machine.

2. The system of claim 1 wherein said computer means is programmed such that if the at least one intended receiving facsimile machine is busy or otherwise unable to receive a transmission at the time the store and forward facility attempts to transmit a facsimile message stored in the mass storage means, the store and forward facility periodically retries transmitting the facsimile message to the at least one intended receiving facsimile machine.

3. The system of claim 2 wherein said computer means is additionally programmed to establish a linked queue in said mass storage means spooling all stored facsimile messages intended for a particular receiving facsimile machine, and transmitting all the spooled facsimile messages intended for that particular receiving facsimile machine upon successfully making contact with the intended receiving facsimile machine.

4. The system of claim 1 wherein said computer means of said at least one store and forward facility is programmed, upon successful completion of a facsimile transmission to an intended receiving facsimile machine, to transmit a message to the transmitting facsimile machine confirming delivery of the transmission to the intended receiving facsimile machine.

5. The system of claim 2 wherein said computer means of said at least one store and forward facility is programmed, upon being unsuccessful in making a transmission to an intended receiving facsimile machine, to transmit a message to the transmitting facsimile machine indicating that the message has been entered into the mass storage means at the store and forward facility, and at least also indicating the reason for

a delay in transmitting the message to the intended receiving facsimile machine.

6. The system of claim 1 wherein the at least one store and forward facility includes means for receiving broadcast instructions from a user at a transmitting facsimile machine and associating those broadcast instructions with a facsimile message received from the transmitting facsimile machine and stored in the mass storage means, and for transmitting the stored facsimile message to a plurality of receiving facsimile machines in accordance with the broadcast instructions.

7. A system in accordance with claim 1 wherein said mass storage means additionally includes mailboxes associated with particular system subscribers and wherein facsimile messages received and stored by the mass storage means and intended for receiving facsimile machines associated with those subscribers are stored in the respective mailboxes, said store and forward facility being responsive to instructions received from a subscriber to transmit the facsimile messages stored in that subscriber's mailbox to any particular facsimile machine designated in the instructions by the subscriber, whereby a subscriber who is traveling or otherwise away from the fixed location of his facsimile machine may have facsimile messages intended for receipt by his facsimile machine collected, and retrieve them from any location where any other facsimile machine is situated.

8. A system in accordance with claim 1 wherein said computer means of said at least one store and forward facility is programmed to retain a facsimile message in the mass storage means for a predetermined time period even after successful transmission of the facsimile message to an intended receiving facsimile machine, and wherein the store and forward facility is responsive to instructions received from either originating or receiving subscribers to retransmit the facsimile message to another intended receiving facsimile machine.

9. A system in accordance with claim 1 for use in system operation wherein individual subscribers may be provided with unique PIN numbers, wherein individual subscriber PIN numbers are stored in the mass storage means, and wherein the store and forward facility recognizes an incoming facsimile message that is security coded by a transmitting facsimile machine, and wherein the security coded facsimile message is sent to an intended receiving facsimile machine only upon receipt from the intended receiving facsimile machine of the appropriate subscriber PIN number.

10. A system in accordance with claim 9 where said computer means is programmed such that, upon receipt by the store

and forward facility of a security coded facsimile message from a transmitting facsimile machine, the store and forward facility sends a transmission to an intended receiving facsimile machine indicating that the store and forward facility is holding a security coded facsimile message, whereby a subscriber at the intended receiving facsimile machine is prompted to input to the store and forward facility his PIN in order to have the facsimile message transmitted to the intended receiving facsimile machine.

11. A method for facilitating facsimile communications between a transmitting facsimile machine and at least one intended receiving facsimile machine, comprising the steps of providing at least one store and forward facility having computer means for controlling its operation and having mass storage means for storing facsimile messages, coupling the at least one store and forward facility to the switched telephone network for receiving facsimile messages from transmitting facsimile machines, recording received facsimile messages in the mass storage means together with information indicating the transmitting facsimile machine and the intended receiving facsimile machine, and transmitting facsimile messages stored in the mass storage means to intended receiving facsimile machines.

12. A method in accordance with claim 11 including the step that if an intended receiving facsimile machine is busy or otherwise unavailable to receive at the time the at least one store and forward facility attempts contact to transmit a facsimile message, of periodically retrying to transmit the facsimile message to the intended receiving facsimile machine.

13. A method in accordance with claim 11 including the step of establishing a linked queue in the mass storage means spooling all stored facsimile messages intended for a particular receiving facsimile machine, and transmitting all the spooled facsimile messages intended for that particular receiving facsimile machine upon successfully making contact with the intended receiving facsimile machine.

14. A method in accordance with claim 11 including the step, upon successful completion of a facsimile transmission to an intended receiving facsimile machine, of transmitting a message to the transmitting facsimile machine confirming delivery of the transmission to the intended receiving facsimile machine.

15. A method in accordance with claim 11 including the step, upon being unsuccessful in making a transmission to an intended receiving facsimile machine, of transmitting a message to the transmitting facsimile machine indicating that the message has been entered into the mass storage means at the store and forward facility, and at least also indicating in the message the reason for a delay in successfully transmitting the message to the intended receiving facsimile machine.

16. A method in accordance with claim 11 including the step of providing the at least one store and forward facility with means for receiving broadcast instructions from a user at a transmitting facsimile machine and associating those broadcast instructions with a facsimile message received from the transmitting facsimile machine and stored in the mass storage means, and including the step of transmitting the stored facsimile message to a plurality of receiving facsimile machines in accordance with the broadcast instructions.

17. A method in accordance with claim 11 including the step of defining mailboxes in the mass storage means associated with particular system subscribers, and including the step of storing facsimile messages intended for those particular system subscribers in their respective mailboxes, and further including the step, in response to instructions received from a system subscriber, of transmitting facsimile messages stored in that subscriber's mailbox to a facsimile machine designated by that subscriber in the instructions.

18. A method in accordance with claim 11 including the step of retaining facsimile messages in the mass storage means for a predetermined time period after successful delivery of the facsimile messages to intended receiving facsimile machines, and, in response to instructions received from either the transmitting or receiving facsimile machines with respect to a particular facsimile message, the step of retransmitting that particular facsimile message to additional intended receiving facsimile machines.

19. A method in accordance with claim 11 including the step of providing subscribers with unique individual PIN numbers, storing the individual PIN numbers in the mass storage means, recognizing an incoming facsimile message from a transmitting facsimile machine which has been security coded, transmitting to the intended receiving facsimile machine for the security coded message a message indicating that the store and forward facility is holding a security coded message, and transmitting to the intended receiving facsimile machine the security coded message only after receipt by the store and forward facility from the intended receiving facsimile machine of the unique PIN number of a subscriber associated with that intended receiving facsimile machine.

20. A method for facilitating facsimile communications between a transmitting facsimile machine and at least one intended receiving facsimile machine, comprising the steps of providing a plurality of store and forward facilities at geographically spaced locations each having computer means for controlling its operation and having mass storage means for storing facsimile messages, coupling each store and forward

facility to the switched telephone network for both receiving from and transmitting to a plurality of facsimile machines associated with each store and forward facility facsimile messages, recording in the mass storage means each facsimile message transmitted from an associated facsimile machine together with information indicating the transmitting facsimile machine and the intended receiving facsimile machine, and transmitting facsimile messages stored in the mass storage means to intended receiving facsimile machines if those intended receiving facsimile machines are associated with the store and forward facility which received the facsimile message from a transmitting facsimile machine, or to another of the plurality of store and forward facilities if the intended receiving facsimile machine is associated with the another store and forward facility.

21. A method in accordance with claim 20 including the step that if an intended receiving facsimile machine is busy or otherwise unavailable to receive at the time a store and forward facility attempts contact to transmit a facsimile message, or periodically retrying to transmit the facsimile message to the intended receiving facsimile machine.

22. A method in accordance with claim 21 including the step of establishing a linked queue in each mass storage means spooling all stored facsimile messages intended for a particular receiving facsimile machine, and transmitting all the spooled facsimile messages intended for that particular receiving facsimile machine upon successfully making contact with the intended receiving facsimile machine.

23. A method in accordance with claim 22 including the step, upon successful completion of a facsimile transmission to an intended receiving facsimile machine, of transmitting a message to the transmitting facsimile machine, either directly or through another store and forward facility associated with that particular transmitting facsimile machine, confirming delivery of the transmission to the intended receiving facsimile machine.

24. A method in accordance with claim 23 including the step, upon being unsuccessful in making a transmission to an intended receiving facsimile machine, of transmitting a message to the transmitting facsimile machine, either directly or through another store and forward facility associated with that particular transmitting facsimile machine, indicating that the message has been entered into the mass storage means at one of the store and forward facilities, and at least also indicating the reason for a delay in successfully transmitting the message to the intended receiving facsimile machine.

25. A method in accordance with claim 24 including the step of providing the store and forward facilities with means for receiving broadcast instructions from a user at a transmitting facsimile machine and associating those broadcast instructions with a facsimile message received from the transmitting facsimile machine and stored in the mass storage means, and including the step of transmitting the stored facsimile message to a plurality of receiving facsimile machines in accordance with the broadcast instructions, either directly or through additional store and forward facilities associated with particular ones of the plurality of intended receiving facsimile machines.

26. A method in accordance with claim 25 including the step of defining mailboxes in the mass storage systems of each store and forward facility associated with particular system subscribers associated with particular store and forward facilities, and including the step of storing facsimile messages intended for those particular system subscribers in their respective mailboxes, and further including the step, in response to instructions received from a system subscriber, of transmitting facsimile messages stored in that subscriber's mailbox to a facsimile machine designated by that subscriber in the instructions.

27. A method in accordance with claim 26 including the step of retaining facsimile messages in the mass storage means for a predetermined time period after successful delivery of the facsimile messages to intended receiving facsimile machines, and, in response to instructions received from either the transmitting or receiving facsimile machines with respect to a particular facsimile message, the step of retransmitting that particular facsimile message to additional intended receiving facsimile machines.

28. A method in accordance with claim 27 including the step of providing subscribers with unique individual PIN numbers, storing the individual PIN number in the mass storage means of a store and forward facility associated with a particular subscriber, recognizing an incoming facsimile message from a transmitting facsimile machine which has been security coded, transmitting to the intended receiving facsimile machine for the security coded message a message indicating that the store and forward facility is holding a security coded message, and transmitting to the intended receiving facsimile machine the security coded message only after receipt by the store and forward facility from the intended receiving facsimile machine of the unique PIN number of a subscriber associated with that intended receiving facsimile machine.

29. A system in accordance with claim 1 wherein said computer means is programmed to store in the mass storage means relevant charging parameters including number of pages, destination and special system feature options provided for each facsimile message sent by a subscriber and received by a subscriber from a non-subscriber, and to generate charging summaries for subscribers periodically from the stored charging parameters.

30. A method in accordance with claims 11 or 20 including the step of storing in the mass storage means relevant charging parameters including number of pages, destination and special system feature options provided for each facsimile message sent by a subscriber and received by a subscriber from a non-subscriber, and generating charging summaries for subscribers periodically from the stored charging parameters.

31. A method in accordance with claims 11 or 20 including the step, upon receipt of a facsimile message from a transmitting facsimile machine, of immediately attempting delivery of the facsimile message to an intended receiving machine at the same time the message is being recorded in the mass storage means.

32. A method in accordance with claims 11 or 20 including the step that when an additional facsimile message intended for a particular receiving facsimile machine is received by a store and forward facility while that facility is in communication with that particular facsimile machine, the additional facsimile message is immediately appended to a message queue for the particular facsimile machine and delivered as part of the communication with that particular facsimile machine.



Facsimile Telecommunications System and Method

Field of the Invention

The field of this invention is telecommunications systems used in connection with facsimile transmissions. More specifically, this invention relates to a system and method for enhancing ease of facsimile transmissions and providing features relative to facsimile transmissions not heretofore available.

Background of the Invention

The electronic transmission of documents by way of facsimile (fax) systems employing public and private switched telephone networks has become both commonplace and, often, an essential component in many business activities. In such a setting, it is very common for the fax terminals (fax machines) to be kept quite busy during a major fraction of the business day. Moreover, where sender and recipient are in different time zones, the "business day" can approach 24 hours, particularly in international activities. It is common for fax users to "broadcast" documents to a number of different recipients, that is, send the same message to several different fax machines. It is also true that the contents of some faxed documents are of such a sensitive nature that the originator or addressee would like to have a measure of control over who might see those documents as they move from the receiving machine to the hands of the actual addressee.

These circumstances present a number of practical problems for a fax user. In order to make a successful fax transmission it is necessary that the receiving machine be available at the time that the transmitting machine attempts to contact it. If the receiving machine is already in use handling another message, the transmitter will receive a "busy" signal. The originator's only recourse is to continue initiating telephone calls until contact can be established. This is a "hit or miss" process at best and can be very wasteful of the originating operator's time.

Some, rather expensive, fax machines have digital memories which will allow them to memorize the document to be transmitted and to be programmed to make multiple redials in an effort to establish contact in an automatic way. However, this is limited to only one or two documents and, more importantly, it ties up the transmitting machine until the effort is successful or abandoned. This is hardly an acceptable solution if that machine has other documents to send or receive.

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There are other conditions which can result in a failure to transmit even though a telephone connection has been established. Perhaps the most common of these is the absence of paper in the receiving machine. In such situations, repeated attempts to "redial" will lead to repeated toll charges with each attempt, with no actual success until the receiving machine is serviced (which may be some time if the machine is operating unattended because it is nighttime half-way around the world).

Busy machines which are destined to receive messages are affected by the converse problem. Since they and the prospective transmitting machines must engage in (perhaps, automated) "telephone tag", they are used very inefficiently. When a transmitting machine gets a busy signal, even if it automatically redials, it can only guess at when the receiving machine will be available. Thus, the receiving machine will likely remain idle for some fraction of the time until such an attempt is made.

The practice of broadcasting documents to a number of addressees obviously compounds these problems and adds still others of its own. Even if one does not encounter busy signals or impaired machines, convenient broadcasting demands an expensive memory-type fax machine on the transmitting end. Such machines read in the document once and then proceed to automatically dial the various recipient machines. This process ties up the sending machine and its telephone line and makes them unavailable for incoming calls. This, of course, exacerbates the busy signal problem for those units trying to contact the sending machine.

The security of sensitive documents is still another problem. Once contact is established between two fax machines, the transmission of the document proceeds automatically, irrespective of who may be standing by the receiving machine at the time. In a busy office, the contents of these documents are accessible to the fax operator and anyone else who happens to be in the vicinity.

It is also common for individuals to wish to deliver fax documents to a recipient who is not currently available through a known machine (eg. a person on a business trip). This is a very inconvenient situation in that it requires that the paper documents be held until the traveler phones in from a remote machine. It further requires that there be someone available at that time who has knowledge of and access to the documents intended for the recipient.

Still another concern is adequate accounting control over the billing of calls. Typically, many businesses wish to be

able to track the costs of both fax machine use and the associated telephone charges. While telephone charges can be ascribed from telephone company records, in the present environment these must be related to records of the number of pages transmitted per call and so forth, separately maintained by the fax machine or its attendants.

Summary of the Invention

The objects of this invention are to address these many shortcomings of present fax systems and to provide an integrated system for their solution. Furthermore, the intention is to achieve this in a way which is fundamentally compatible with existing fax terminal machines. The basic approach is to provide special computer-based fax Store And Forward Facilities (SAFF's) as an integral part of a switched telephone network system. All fax transmissions entered into the network are routed to such a facility, typically geographically near the originating machine, where they are temporarily stored or "spooled" by the computer in a mass storage buffer, such as a magnetic disk.

The fax message from the originating machine is intended for a destination machine, which may or may not be in a position to immediately answer the call. If the destination machine is within the service region of that SAFF, the system then proceeds to attempt to call the destination fax machine. If the destination machine is within the service area of a different SAFF, the system forwards the fax document data to that facility by long-distance lines, in which case this second facility attempts to call the destination machine. In either case, if contact is established and the message is delivered immediately, the system directs a printed report back to the originating fax machine confirming delivery to the destination machine, and other pertinent data.

If, on the other hand, the delivery cannot be completed immediately due to a busy signal, a machine fault (eg, receiving machine out of paper) or any other reason, the spooled document is saved and the system makes periodic attempts to contact the destination machine and complete the transmission.

In the meantime, the system sends a printed report back to the originating machine acknowledging that the message has been entered into the system, indicating the reason the delivery is being delayed, stating the protocol the system will take to deliver the message, and providing a reference number or "Message Code" which identifies the message and may be used at a later time to trace the status of the document.

Placing the delivering spooling system geographically near the destination machine has the advantage of more economical use of any long-distance lines that may be involved. These lines are used only to move the message from the originator to the spooling system in the vicinity of the destination, which is virtually certain to be successful on the first try. Subsequent attempts to contact the destination machine can be handled more or less locally and need not tie up the bulk of the long-distance facilities.

If the delayed delivery is ultimately successful, the system will send a printed delivery report to the originating machine. On the other hand, if the delivery attempt protocol has gone through its whole cycle without success, a report will be sent to the originator indicating that the delivery procedure has failed and requesting instructions as to how to proceed (eg. try again, redirect the message to an alternate number, or delete the message).

An important feature of the system is that it recognizes all of the documents that are spooled in the system at a given time for a given destination machine. These are identified and linked together to form a message queue for that machine. In this way, once contact is established, all of the waiting messages can be "dumped" to that machine in a continuous batch. Furthermore, if new messages arrive while that dump is occurring, they are simply appended to the end of the active queue and are transmitted when their turn comes. This has the advantage of greatly enhancing the utilization efficiency of a busy destination machine.

Since all outgoing fax documents are temporarily stored at the facility near the originating machine, it is also practical to provide for automatic broadcasting of documents to multiple destinations. Lists of "broadcast groups" of phone numbers can be programmed into the facility by users, or a list of destination phone numbers entered "by hand" at the time of a call. The SAFF can then broadcast the message to every machine of the selected list. This is a great advantage to broadcast users in that they need only tie up their machines for one outgoing transmission, the one to the SAFF. The SAFF copies the message to all of the destination machines as outlined above. In the meantime, the originating machine is available for receiving or transmitting other documents.

Similarly, since the documents are stored near the originator, the system can permit messages which have already been sent to be copied to other destinations after the fact, without the necessity of resending the message to the SAFF. Likewise, since the messages are also spooled in a facility near the destination, the system also provides the recipient with

the option of forwarding or redirecting documents to still other destinations, as if the recipient were the originator. The system can also accept and store messages destined for a fictitious destination or "Mail Box". Thus, individuals who are traveling can, at their convenience, dial into the system and pick up any waiting documents.

Closely akin to these features is the ability to have the originator of a transmission include the requirement that the recipient provide a security code, such as a PIN number, in order to release the document from the spool to the destination machine. In this case, the SAFF sends a written report to the destination machine advising that a secure message is waiting for a particular recipient and the fax identification of the originating machine. The recipient must then call in to the SAFF and key in the security code to initiate the delivery of the document. Since the document is spooled, the delivery easily may be delayed until the recipient is available to supply the code.

Finally, since the documents and their delivery are both under the control of the telephone system, as a special service the telephone call accounting system can provide both time and charges for the telephone services rendered and fax information, such as pages transmitted, sorted according to the originator's clients. This can greatly facilitate the fax user who wishes to do cost accounting or to bill clients for costs incurred.

Brief Description of the Drawings

Other objects and advantages of the present invention will be apparent from the following Detailed Description of the preferred embodiments thereof and from the attached Drawings of which:

Fig. 1 illustrates the inter-relationships of the principal elements of a connection between two SAFFs.

Fig. 2 shows a more detailed view of the various systems within a single SAFF, such as those shown in Figure 1.

Fig. 3 illustrates the major components of the Originate Function in the SAFFs shown in Figures 1 and 2.

Fig. 4 illustrates the major components of the Answer Function in the SAFFs shown in Figures 1 and 2.

Figs. 5a and b show a flow chart describing the general processing steps required to handle a fax or voice message

incoming to the Originate Function of a SAFF, as described particularly in Figures 2 and 3.

Figs. 6a and b show a flow chart describing the general processing steps required to handle the delivery of a fax message incoming to the Answer Function of a SAFF, as described particularly in Figures 2 and 4.

Fig. 7 shows a flow chart of the general processing steps required to handle a service request in the General Service unit of a SAFF, as described particularly in Figure 2.

Detailed Description

Introduction

The preferred embodiment of this invention is a multi-function, interactive facsimile transmission system which is integrated into a switched telephone distribution network, where "network" is taken broadly to mean the entire system required to complete a communication from an originator to an answerer. This embodiment provides a comprehensive computerized fax message management system based on automated fax Store And Forward Facilities (SAFF) embedded in the network. This system requires no modifications to existing facsimile machines, but rather, relies on the network to provide the enhanced services.

The system contains several components which actually transmit the fax messages and related information, provide written fax reports to users about the status of messages within the system, allow user intervention in the sequence of automatic actions of the system, provide an accounting of services rendered for both the customer and the telephone company, and control and supervise all of these activities.

In the preferred embodiment, it is presumed that the SAFF's are placed at the interface between the local telephone delivery system and the long-distance delivery system, as indicated in Figures 1 and 2. In this setting, the SAFF system can be controlled and its services offered by either one. However, it is obvious that useful systems can be constructed where the SAFF exists as close to the user as a component of his or her own in-house telephone system (such as a PBX or Centrex) or as remotely as a single, independent, stand-alone SAFF serving a wide geographical area. It is also obvious that commercially viable systems can be constructed which provide subsets of the features of the preferred embodiment. The choice of site/control setting and service features might be driven by any number of economic, market, or legal

considerations, which would militate toward offering the system at an alternate location in the network, or in a "stripped down" form.

To more clearly understand the present invention, it is useful to consider the manner in which a fax transmission occurs in the traditional setting. Here the communication between two machines is initiated when the destination machine answers a telephone call directly from the originating machine. Typically, there is an exchange of digital data identifying the sending and receiving machines to each other and establishing the fax mode or format to be used. If this exchange is satisfactory, then the actual image transmission takes place. Otherwise, the call is terminated, usually with some form of written diagnostic to the respective users.

Message Interception

In the present invention, all fax transmissions initiated by a subscriber to the fax management system are first intercepted by an "originator" SAFF; that is, the SAFF which directly services the originating fax machine. Figure 1 shows two exemplary SAFFs 8 and 18, with interconnections between the SAFFs and with subscriber fax machines being diagrammatically indicated. Thus in Figure 1, the SAFF 8 includes an originate function 9 coupled over telephone lines 4 to originating fax machines 1. Likewise, the SAFF 18 includes an originate function 22 coupled over telephone lines 26 to originating fax machines 30. Each of the SAFFs 8 and 18 also includes respective answer function blocks 12 and 19 respectively connected over telephone lines 6, 24 to fax machines 3, 28. Each of the SAFFs 8, 18 also includes service interfaces 10, 21 coupled via telephone lines 5, 25 to telephones 2, 29. The function and purpose of the service interfaces is more fully explained hereafter, and they are under control of status and control blocks 11 and 21.

Access to the system of Figure 1 can be obtained much the same as access to a specific long-distance company's network. That is, subscribers such as 1 in Figure 1 can dial a unique access code at the time a call is initiated, or a telephone line dedicated to a fax terminal may be permanently routed to the SAFF system, in this case the SAFF 8 of Figure 1. Either way, one accesses SAFF Directed Lines 4 and the SAFF 8 itself in the process of dialing the destination fax machine.

The SAFF 8 then answers the phone in place of the destination machine, such as one of 28 shown in Figure 1 as serviced by SAFF 18. For the moment, this SAFF 8 near the originator becomes the proxy for the destination machine 28. While

noting the actual destination telephone number, the SAFF 8 engages the originating machine in the same digital dialogue that would have occurred if a direct connection to the destination machine had actually been made. Thus, it echoes back the destination telephone number, to identify the intended destination machine, and agrees to accept the fax format requested by the originating machine.

This causes the originating machine 1 to respond by transmitting the fax document image data. The originating machine's identification, the destination machine's telephone number, the fax format, and the document image data are all stored on a mass storage device 67 (in Figure 3), such as a computer magnetic disk unit. Furthermore, a unique alphanumeric Message Code is assigned to the block of data to identify it while it is resident in the SAFF system. This Message Code is related to the file name for the stored data.

Delivery

At this point the SAFF 8 initiates two actions. The first is to generate an "Acceptance Record" of the transaction to this point. This record, in one form or another, will be returned to the originator as will be described below. The second step is to begin to deliver the fax message to the destination machine 28.

The details of the delivery process depend to some degree on the geographic location of the destination within the network. A single SAFF can, in principle, service a broad geographical area. However, in the preferred embodiment, communications beyond a certain limiting distance involve at least two SAFFs, one 8 near the originator 1 and the other, a "destination SAFF", 18 near the recipient 28 of the document. The choice of one, two, or more SAFFs is determined by network economics, or other considerations, and is not essential to the invention.

For the sake of this discussion, we will define a "local" message to imply that the originating and the destination machines are serviced by the same SAFF. (Although, this does not preclude the possibility that the two machines are some considerable distance apart and connected by a toll call.) On the other hand, we will define a "long-distance" message to mean that the originating and destination fax machines are serviced by different SAFFs and, thus, one SAFF must exchange data with the other, perhaps through intermediaries. Similarly, the term "near" used in connection with a SAFF refers to being within the service area of that SAFF.

Each SAFF 8, 18 has two clearly defined roles: the "Originate Function" 9, 22 for handling data with an originating machine, and the "Answer Function" 19, 12 for handling data with a destination machine. The details of these two subsystems are illustrated in Figures 3 and 4 respectively. In the local message mode, the connection between the Originate Function, such as 9, and the Answer Function, such as 12, is linked within the single SAFF 8 by way of a Local Call Loop-back connection 13, between the two Functions. In the long-distance mode, the Originate Function 9 of SAFF 8, near the originator, is linked to the Answer Function 19 of another SAFF 18, near the destination, by long-distance lines, such as 14, or 16 for SAFF 18. Thus, processing a long-distance message involves the same basic steps as a local message, except that the activity is shared interactively between at least two different SAFFs.

Originate Function

With this understanding of SAFF functions, the following detailed discussion will illustrate the operation of the system in the long-distance case, since it is the more complex, and therefore provides a more comprehensive example. Figures 1, 2, 3, and 4 all show elements of the SAFF system in varying degrees of detail and all will be referred to in the following. It will be noted that some critical elements are shown in more than one of the Figures.

As an example, it is assumed that one of the subscribers 1 attached to SAFF 8 wishes to send a fax message to one of the subscribers 28 attached to SAFF 18. The subscriber 1 places the call to the destination machine 28 which is routed over SAFF Directed Lines 4 to the Originate Function 9 of SAFF 8. These signals originate within the SAFF system and they are picked up by the On-net Interface 64 which is part of the Originate Function, as shown in Figure 3. This Interface signals the Originate Host Computer 70 of the incoming call and the Host responds by directing the incoming data to a Mass Storage Unit 67 where it is stored in a file 68.

During this storage process the Host directs two other activities. It creates a call status record file 69 (Figure 3) in mass storage, recording the time and date of the origination, the telephone number of the calling machine, the telephone number of the destination machine, any security or other special services requested, various housekeeping information, and it assigns the Message Code number which locates not only the status file but also the fax data file associated with it. The Host also passes the destination machine's telephone number to the Outbound Control unit 74 which proceeds to

connect the originating SAFF 8 with the nearest available SAFF 18 to the destination through a long-distance interface 75 over long-distance circuits 79 (14 in Figure 1). In the process of establishing this connection, the Outbound Control unit employs an algorithm which examines the number and kind of available trunk resources and chooses the most efficient combination of these lines for the task required.

Answer Function

The originating SAFF 8 then proceeds to transmit the originator and destination telephone numbers, the stored fax image, the Message Code, and other housekeeping data to the destination SAFF 18. These data are sent by the most expedient mechanism offered by the long-distance service. For example, if this service employs digital communications, the fax data may well be transmitted at a significantly higher rate than it was originally received into the system.

The fax data is received by the Long-distance Interface 95 (Figure 4) in the Answer Function 19 of the destination SAFF. This unit signals the Answer Host Computer 85 of the incoming data. The Host then routes these data to its Mass Storage facility 87. (It should be noted for later reference that the originator SAFF and the destination SAFF now both have a copy of these data.) The Host notes whether other messages are pending for the destination machine and either opens a Delivery Queue file 88, or appends the new message to the existing Queue File.

The Host also records the arrival time and other pertinent information about the fax message in a Call Status file 90 in Mass Storage unit 87, and sends a status update back to the originating SAFF 8 by way of the Status and Control Interface 84, and the System Status and Control Unit 11 via Long-distance Trunks 15.

It then signals the Local Interface 83 to dial the destination machine's (81 in Figure 4) telephone number on ordinary outgoing local lines 24, 82. If the destination fax's line is available, the destination SAFF now becomes the proxy for the originating fax machine and engages the destination machine in the necessary preliminary digital dialogue.

If this is successful, the document image, including the source and destination identification information, the Message Code, and the entry and delivery times, is played back from storage and delivered to the destination. A "Delivery Record" is then created by the Answer Host 85 which indicates the date and time of delivery, and any other pertinent data. The

Delivery Record is sent back to the originating SAFF 8, again by way of the Status and Control Interface 84, and the System Status and Control Unit 11, via Long-distance Trunks 15. The originator SAFF 8 then appends this information to the Acceptance Record to form a complete "Transaction File". The originating SAFF 8 then sends this file, as a delivery receipt or report, back to the originating machine 1, 60, as a fax document.

If the destination machine's line is busy, or the contact fails for some other reason, the destination SAFF's Host Computer 85 will enter a sequence whereby it will attempt to contact the destination machine and transmit the document on a predetermined schedule for a specific period of time or number of tries. As this sequence is entered, a "Retry Record" is generated documenting the situation and the system's response to it. This record contains the reason that the delivery was delayed and it indicates which protocol the system will use to attempt to deliver the message. This is transmitted back to the originating SAFF 8, as described above, and appended to the previously described Acceptance Record to form a Transaction File which is then sent as a fax message back to the originator. The assigned Message Code is a part of every transaction report and may be used at any time to trace the status of undelivered documents, as will be described shortly.

If the retry effort is ultimately successful, a Delivery Record is appended to the Transaction File which is sent back to the originating machine. If the effort fails after reaching the predetermined limit, this is also recorded, appended, and sent back to the originator. In this case, the originator is given the option of dialing back into the system within a certain length of time (typically several hours) and instructing the destination SAFF as to how to dispose of the document (eg. repeat retry sequence, forward to a different telephone number, or delete the message).

This process is handled by using an ordinary touchtone phone to dial a multipurpose (perhaps, toll free) fax system "Service Number"; which will be referred to here and in later sections. This might be a unique number for every SAFF, or it might be a standardized number common to many localities, except perhaps for area code, such as is 555-1212 for calling "Information". This Service Number is answered by the General Service Control units (10 in Figure 1, 50 in Figure 2) of the SAFF to which the call is directed. This unit contains an automated voice response system that presents a menu of the available services and prompts the user to select the desired choices by pressing particular numbers on the touchtone keypad. In an advanced embodiment, a computer-based voice

recognition system replaces the keypad and accepts verbal commands in a conversational way.

The General Service Control unit 50 can communicate with its own System Status and Control unit 11, and through that unit, any other such unit 11, 20 via Long-distance Trunks 15. Through these connections, both inquiries relating to messages in the system and instructions as to their disposition may be addressed to the entire SAFF system.

Having selected the "failed-connection message disposition" choice, the user is prompted to key in the Message Code. The system verbally repeats the code and the delivery discrepancy for verification, and then presents a menu of disposition options for the user to select with the keypad.

If the user does not take advantage of this "what to do now" opportunity within the time limit, the message is retransmitted back to the originator with a report. It is then erased from both the originator and destination SAFF files after a suitable delay (typically six hours). If the originator wishes to resend the message during this "grace" period, it may be recovered and resent to the original destination or forwarded to another destination(s), as will be described later.

In each of the various cases where the SAFFs automatically direct fax message status reports (such as, the Acceptance, Delivery, or Retry records above), the system can be programmed to accumulate records from all calls over a period of time (eg. an hour) at the originator SAFF and deliver them as a single fax document at the end of the period or upon request by the originator. This has the advantage of reducing the number of report calls and the subsequent burden on the originating fax machine. The originator SAFF will enter a retry sequence if it finds the originator's line busy or the machine unavailable when it attempts to deliver reports. This is a persistent sequence which it will continue trying for direct contact at intervals of an hour or so for a considerable length of time (eg. 72 hours). It also places a copy of the report in the originator's Mail Box (described below) so that the originator may recover it in between SAFF delivery attempts.

It should also be noted that the originator has the option of dialing the Service Number at any time and inquiring about the status of a given message. Here again, the voice response system prompts, presents menus, and uses the Message Code to locate and report on the current location and condition of the message. A written record can be directed to the originating or destination fax machine, if desired.

Another feature of the system is that the act of accepting and storing an incoming message at the originator SAFF, and the act of dialing and forwarding that message to the destination by the destination SAFF, can overlap in time. That is, if the originator SAFF has lines available, once the initial connection dialogue between the originator and the SAFF is complete, the SAFF may immediately make its first attempt to contact the destination SAFF and, thus, the destination machine, while it is beginning to spool the document.

If this immediate contact is successful, then the message is passed from the originator SAFF 8 to the destination SAFF 18 to the destination machine 28 directly from the Originate Host Computer's memory 70 while the two SAFFs are still in the process of spooling the document to disk. This is facilitated by a "write-through pipeline" whereby the Originate Host 70 passes the incoming fax data through directly to the Outbound Control unit 74 at the same time it is being written to mass storage. It is held in a temporary memory buffer in the Outbound unit until it is clear whether or not an immediate connection to the destination machine is possible. At that point the temporary buffer fax data is either sent and then deleted, or merely deleted. The net effect is that the spooling process only adds a few seconds delay in the message delivery over the traditional direct machine-to-machine contact when the destination machine is readily available.

On the other hand, if lines are limited, the originating SAFF can choose to delay until suitable lines are available. This has the advantage of improving communications resource management and enhancing the efficiency of the telephone system's line usage over the direct contact scheme.

The foregoing describes the basic fax SAFF message handling system and from this discussion several advantages should be apparent. The originating machine always functions as if it makes contact and delivers documents on the first try, thus immediately freeing the machine and the attendant personnel for sending or receiving other transmissions. Likewise, the telephone system only handles one call across its local and long-distance lines from the originating machine to the destination SAFF, since the state of the destination machine has no impact on the call. This significantly improves the efficiency of line usage when messages are addressed to busy fax terminals.

Although some additional calls are needed to deliver the various reports, these require very little long-distance time, as they are transmitted over the circuits as highly compressed coded messages. It is the nearby originating SAFF that translates them into "plain language" for fax delivery as a local

message. As pointed out, additional savings in these local messages can be gained by compiling multiple reports and delivering them in bulk as a single call. It should be noted that the delivery of reports to an originator is a cooperative process between the Originate Function and the Answer Function of the originate SAFF. The Originate Function 9 actually generates these reports and passes them through the Local Call Loop-back 13 (76 in Figure 3) to the Answer Function 12 for delivery as an ordinary fax message.

In addition to these basic features, the design of the system also provides for a number of additional services and advantages which are described below.

Message Queuing

As pointed out, all fax messages directed to a particular telephone number are spooled by the Answer Function of the destination SAFF, as detailed in Figure 4. The Host Computer 85 controlling this function monitors the incoming messages and links all undelivered messages for a given telephone number into a message Delivery Queue file 88. The computer also compiles a constantly updated, ordered catalog of the file names of the messages waiting for each fax machine.

Consequently, when messages arrive at a rate faster than they can be delivered, for whatever reason, they are held in this queue for delivery. As soon as the destination SAFF establishes contact with the destination machine, it begins sending the entire queue of messages in a single, essentially uninterrupted transmission. Messages that arrive while the transmission is in progress are appended to the end of the queue.

This scheme eliminates the "trial and error" dial and redial attempts that result from a number of independent incoming calls competing in an uncoordinated way for the single destination line. It can significantly enhance the efficiency of the destination fax machine and the long-distance and local telephone circuits connected to a busy machine.

When the queue exceeds a certain limiting size, the destination SAFF will periodically insert and send a "Queue Report" (as a fax document) to the destination machine showing a list of the waiting messages. This list shows the originating machine identification, the time entered into the originator SAFF, the number of pages in the document, and the approximate time that the message will be delivered based on its position in the queue.

The user can advance a particular message to the head of the queue by calling the fax Service Number and supplying the desired message number, by using the voice response menus. The General Service unit 50 directs these instructions to the System Status and Control Unit 11, which in turn directs them to the Answer Function Host 85 through its Status and Control Interface 84.

Alternately, the originator can designate a priority level to a given fax message at the time it is dialed in (eg. by using a different access code). In this case, the destination SAFF will insert higher priority messages ahead of lower priority messages in the queue as they are received. The originator would normally pay a premium price for this service.

Another originator option is the time of delivery. If desired, the originator can specify the time of day which the message should be delivered. In this case the message is forwarded to the destination SAFF directly, but is not entered into the queue until the specified time. This can be used in combination with an assigned high priority to insert the message at the head of the queue at the appointed time.

When messages are finally delivered to the destination machine they are not immediately erased from the spool file 88 at the destination SAFF. Rather, they are maintained in a "Delivered Message" directory 90 for a period of time (typically six hours). A feature offered by this action is the opportunity for the subscribing recipient of a message to make additional copies, redirect, or forward copies of selected messages to other destinations. This is accomplished by calling the Service Number and selecting the appropriate choices from the voice response menus.

Security and Mail Boxes

It is not uncommon for documents of a sensitive nature to be sent by facsimile from place to place. This is often a problem, especially in a busy office or where a machine is nominally unattended during the transmission, in that the originator has no control over who may be standing by the machine when the document prints out, or who may leaf through a stack of faxes piled up in a hopper right after lunch.

This is a problem which others have attempted to deal with in a variety of ways. For example, Bond, U.S. Pats. 3,594,495 and 3,641,432, discloses a "radio facsimile postal system" which features the direct delivery of documents to specific addressees by facsimile via communications

satellites. In this system, intended as a replacement for or supplement to the ordinary "paper" postal system, fax messages were directed from special public fax terminals operated by the post office to a central satellite earth-station. Here the messages were sorted according to their geographical destination for concentration and uplinking to a satellite servicing that area. The satellite then broadcasts all of the uplinked messages back to Earth.

In principle, anyone with a radio receiver in the satellite's service area could access any of the messages, so Bond built in a "privacy code" which operated with the receiver to allow the message to print out only on the desired machine. In reality, this privacy code was nothing more than an addressing signal which enables the selected fax receiving system. Thus, Bond's system is merely a restricted version of the services presently provided to fax users by the telephone networks. His privacy code function is the same as a telephone number: it selects which of a plurality of fax machines will actually receive the message. Unfortunately, his approach leads to exactly the security dilemma facing telephone fax users.

Chapman, U.S. Pat. 4,106,060, has approached the problem in a somewhat different way. He too discloses a facsimile-based mail system. However, in his system, the messages are directed by whatever means to a "paper" post office near the addressee, rather than the addressee's home or place of business. This post office then makes a paper copy of the fax message, places it in an envelope, and delivers it to the addressee as ordinary mail. This is a reasonably effective solution to the security problem, but it can only be relied upon to provide "next day" delivery, and there are a number of other, competing alternatives for document delivery service on that time scale.

In the present invention the security problem is addressed by a control variation of the destination SAFF queuing system. Messages which the originator wishes to designate as secure are temporarily directed to a auxiliary storage file 54, 89 in the Answer Function of the destination SAFF called a "Mail Box". Instead of being delivered to the destination machine, a report is sent to that machine indicating that a secure message is waiting for a particular addressee. Optionally, a voice message may be directed to a designated telephone number by the General Service Control 50.

This feature works in the following way. Each individual SAFF is assigned its own unique telephone exchange code or codes (typically indicated by the first three digits of a seven digit local number). Thus, the SAFF appears to the

world as if it were a distinct telephone exchange(s), separate from all other exchanges in that area code region. All subscriber's to a given SAFF are assigned their fax telephone numbers with that exchange prefix. Subscribing individuals wishing Mail Boxes (typically associated with a "default" fax machine) are issued "fictitious" telephone numbers which actually terminate in fax Mail Boxes, rather than in an actual telephone line.

Mail Box numbers are published so that correspondents may use them. In addition, each individual is also given a secret security code or PIN number which will access his or her box. The host computer managing the SAFF maintains a list that relates each fictitious number with the individual's name, the security code, and the real telephone number of the default destination machine. This default machine is the one to which messages and reports will normally be sent, when appropriate.

An originator wishing to send a secure message merely dials the (fictitious) Mail Box telephone number at the time the document is sent. The system directs the message to the Mail Box file 89 in the destination SAFF associated with that number, and the Answer Host 85 sends a "Message Waiting" report to the default destination fax machine through the Local Interface 83. If more than one message is in the Mail Box queue, then this report lists them all.

In order to get the fax document actually sent to the destination, the security code must be sent back to the destination SAFF. Typically, this would be done by the addressee dialing his or her own Mail Box number. Since this call originates from a "normal" telephone 34 over Ordinary Local Lines 40, rather than the fax's SAFF Directed Lines 38, the call is directed to the Off-net Incoming Screener 48 in the (destination) SAFF which functions in conjunction with a mailbox service control 49. This unit recognizes that the call is not a fax transmission and thus treats it as a voice service request. A voice response system then prompts the caller to key in the security code. When the correct code is supplied, the SAFF system announces the number of messages waiting and, if desired, the message codes of each. Mail Box contents are maintained in a queue 89 just as are "regular" spool files. Thus, the user is also given the opportunity to reorder the messages within a Mail Box Delivery queue, through the System Status and Control units 11, 20 in the same way as other messages.

The system finally permits the addressee to make a selection of messages for immediate release, and provides an opportunity to "redirect" them to a fax machine 3 other than the default machine over ordinary local lines 39. The SAFF then

releases the selected documents and moves them to the head of the appropriate destination Delivery Queue 88 for immediate delivery.

When messages are accepted into the SAFF system and arrive at a mail box, The Answer Function of the destination SAFF issues a "Posting Report" which is directed back to the Originator in the manner described for other reports. The report is similar to a Delivery Report, except that it indicates that the message has been received by the mail box. When the Mail Box Queue is actually read by the addressee the Destination SAFF sends an actual Delivery Report to the originator indicating the date and time of delivery and so forth.

Another advantage of the Mail Box system is that it can provide a convenient way for individuals who are away from their "home" machine to still have access to their documents. Such individuals may call in to their Mail Box number to hear from the voice response unit whether they have any messages waiting. By use of the redirection feature, messages sent to a fax Mail Box can be accessed by an individual with the security code from any telephone with a fax machine.

For example, a person on a business trip can have all his or her fax documents directed to their Mail Box. Upon arriving at a hotel that has a fax machine, the traveler places a call to the Mail Box number and supplies the information outlined above, including the telephone number of the hotel fax machine. The SAFF then calls the hotel machine and dumps the queue of waiting documents.

Broadcasting

The queuing, Mail Boxes, and security codes are all derivative benefits of the spooling of messages at the destination SAFF. There is a counterpart advantage to the originator SAFF's spooling as well. Since the originator SAFF maintains a copy of each message, that copy can be used to broadcast messages to multiple destinations.

This can be initiated in a number of ways. For example, the user can dial in a code prefix indicating that a list of destination numbers is to follow. The numbers are then entered and finally another code is entered to signal "end of list". The Originate Host 70 recognizes these inputs and attaches them to the message which follows. As an alternative, the user can store different numbered broadcast telephone lists in the Originate SAFF mass storage files 69 (entered much as described above) and invoke them simply by dialing a two or three digit "short-cut" code. In either

case, from there the fax transmission to the originator SAFF proceeds normally.

Upon reception of the list and the document, the originator SAFF proceeds to open as many local loop-back or long-distance lines as it can to deliver the broadcast message to the various destinations, essentially simultaneously. Although the originator is billed for making a number of different calls, in fact the originating machine is only tied up for the time required to make one call. Furthermore, the full power of the delivery system is asserted for each destination machine, including reporting, redials, queuing, and so forth.

A feature related to broadcasting is the redirection of messages by the originator. Since fax messages are spooled at the originator SAFF and held for a period of time even after delivery (typically six hours), the originator can dial the Service Number any time during this period and direct a copy of the spooled message to be sent to other destination machines.

Communications With Non-subscribers

Thus far, the discussion has presumed that both the originator and answerer were subscribers to the SAFF system. It is quite reasonable to assume that subscribers will wish to send or receive fax messages with non-subscribers, as well. While the services provided by the SAFF are more limited in such cases, nevertheless, the system both anticipates and enhances communications with non-subscribers for the benefit of the subscribers.

When a subscriber originates a call to a non-subscriber the delivery process is almost identical to subscriber-to-subscriber calls. The fax data is forwarded to the Answer Function of the appropriate destination SAFF and delivery is pursued, all in the usual way. For the benefit of the subscribing originator, the message is stored in the usual way at the destination SAFF until delivery is completed. If multiple SAFF-processed messages arrive before the delivery is complete, a temporary Delivery Queue will be created and used as required. However, since the non-subscriber will have no account in the system, attempts to use the Service Number to manipulate the queue, forward messages, make multiple copies, and use the other special services available to a subscribing answerer, will be unsuccessful.

Calls originated by a non-subscriber directed to a subscribing answerer move by a somewhat different mechanism. As noted, each SAFF appears to the world as a distinct telephone

exchange and all subscriber's to a given SAFF are assigned their fax telephone numbers with that exchange prefix. Consequently, all calls directed to a SAFF subscriber eventually end up at the subscriber's SAFF, whether they originated from within the SAFF system network or not. Messages originating "off-network" can arrive by any route. For example, they may be truly local calls, or they may be long-distance calls which arrive over any available long-distance network.

In any case, messages originating from a non-subscriber 33 are delivered to the answering fax machine's SAFF by the local lines 39 provided by the local telephone company. They are answered by the SAFF's Off-net Incoming Screener 48, which, upon noting that they are fax transmissions, directs the calls to the Originate Function 9 of that SAFF. From that point, the call is treated as if it were a local fax call and it is passed over to the Answer Function 12 via the Local Call Loop-back 13 for delivery to the subscriber.

In this situation an Acceptance Record will be returned to the originating machine, but no further originator services are provided. On the other hand, the answering subscriber has the full range of Answer Function available.

Charges and Detailed Billing

Normally, the Originate Function of the originator SAFF has ultimate responsibility for the management of outgoing messages. It initiates all connections to the Answer Functions of the various SAFFs with which it must communicate. It is the node to which all reports concerning message status and disposition must flow. It interrogates Answer SAFFs when extraordinary updates are required. Consequently, the Originate Function is also the focus of charging data.

The telephone company presumably charges for all of the various services provided by this system. The method, algorithm, and rates are determined by actual costs and applicable regulations. Typically, the user would be billed for telephone connect time, toll charges, extraordinary services, such as those provided by calling the Service Number, the amount of mass storage space consumed as a function of time, and so forth.

One of the user services for which a special charge might be made is a subscriber's customer specific billing system. In this option the user can "flag" each fax transmission with a keyed-in prefix which contains a user customer, client, or project number. This number is stored as a key field in the

Transaction File for that call. Thus, when the telephone bill is prepared, the billing computer can sort the subscriber's bill on this field and present the user with a list of all fax messages, total usage time, number of pages, and related charges, all grouped by the subscriber's own customers, clients, or projects. Furthermore, it can accept the subscriber's particular algorithm for billing calls to customers or clients and generate a column showing what the subscriber will bill for the service (as a separate matter from what the SAFF system and the telephone company have billed the subscriber). This can be of great assistance in attributing costs and billing customers for services rendered.

Software Control

In the preferred embodiment, each of the principal units of the SAFF such as described in Figures 2, 3, and 4 is controlled by its own computer processing unit or units. These units are interrupt-driven computers which are connected together by the System Status and Control unit 11. This unit is an electronic switch yard for control communications between the Originate, Answer, and other units within a given SAFF, as well as the other SAFFs in the system through the control long-distance trunks 15. While there are many tasks which the various control processors must perform to handle fax operations, the primary ones are intercepting incoming calls, either for fax forwarding or service requests, and delivering the fax messages to their destinations. The general software organization of these principal activities is shown in Fig. 5, 6, and 7. It should be noted that these figures are simplified and intended to be generally descriptive. For example, some procedures illustrated here as sequential (for the sake of simplicity) can actually be performed concurrently. Likewise, not every function of the system is represented in detail. Generally speaking, similar results also can be obtained with a number of other obvious arrangements of the functional blocks.

Broadly speaking, fax messages addressed to the Originate Function of a SAFF arise either through the special SAFF Directed Local Lines 4 (Figures 2 and 3) as a result of direct connection or dialing a special access code, or they arise from Ordinary Local Lines (off-net lines) 39, 40, 63. Those which arrive via off-net lines are processed first by the Off-net Screener 48, which may direct them to either the Originate Function 9 or to Mail Box Service 49. Figure 5, therefore combines all three of these related functions.

At the outset one of the two incoming call interfaces 64 and 65 signals the Host Computer 70 that it is beginning to

process a call at 100 in Figure 5a. These units have their own buffer capability and can tolerate some delay before the Host responds. Ultimately the Host must decide whether it is responding to an on-net or off-net call 101. If it is an off-net call there are two possibilities (excluding wrong numbers) 102: it may either be a fax call, in which case it is from a non-subscriber to a subscriber, or it is a mail box service call. If it is a fax call then the billing for services must be directed to the subscribing destination addressee 112. From that point it is handled like an on-net call as will be described shortly.

If it is not a fax call then it is presumed to be a mail box service call 103, and the caller is presented with the voice response menu 104 for such service. The user responds to these prompts with a touchtone keypad, or verbally, 105 and a decision ladder, shown succinctly as 107 selects the desired implementation routine 108, 109, 110 (for brevity only three typical choices are shown, and this element is actually a loop which will permit multiple commands). The chosen routine passes parameters to a command parser 121 (Figure 5b) which prepares an command statement which is then sent 122 to the System Status and Control unit 11, through the interface 72. This command will be passed to the Answer Host 85 through its interface 84 for actual action on the Mail Box Queue 89. If the service requires a response to the caller the transmission path is reversed. When the operation is completed 123 the call is terminated.

If on the other hand, the original call is found at 101 to be an on-net call, billing is generally directed at the originator 113 and the Host 70 begins the opening digital dialogue 114 with the calling machine, acting in place of the destination machine. This dialogue includes gathering and storing the fax identifications, originating and destination telephone numbers and so forth 116. The Host opens a Transaction File and links it to a data file 117 for the expected data, and then stores all of the call and file information 118 keyed to the Message Code. The destination telephone number and other information are passed almost immediately 119 to the Outbound Controller 74, which then opens a temporary buffer to hold the fax message in case immediate contact can be established, and it attempts to establish that contact through the destination SAFF.

In pursuing this contact, the Outbound Controller 74 examines the status of available trunks. If trunks are available, it will immediately attempt to connect with the destination SAFF, otherwise it will defer the call until a trunk is available. In the event of a broadcast message, the Outbound Controller will select the number of trunks to use

simultaneously based on the percentage of the trunks already in use, in order to avoid tying up all of the SAFF's outgoing capacity with a single message task. Other considerations can affect these usage choices depending on the details of the setting of the system.

The Host then enters a loop which gets the incoming fax data 125 (Figure 5b) from the On-net 64 or Off-net 65 Interface's buffer and stores each byte in the fax data file 126 while sending another copy 127 to the Outbound controller 74 until the incoming data is complete 128. The Host then checks 129 with the Outbound controller to see if it was successful in making immediate connection with the destination machine. If it was successful and a satisfactory transfer occurred, then a Delivery Report is sent back 132 to the originating machine before it leaves the line. Otherwise, an Acceptance Report is sent 131, and in either case the outcome is reported 133 to the Transaction File and the call is terminated 134.

A complementary set of activities occurs in the Answer Function of the destination SAFF as described in Figure 6a and b. Here an incoming call is detected 136 by the Inbound Control 92 (Figure 4). The Answer Host Computer 85 then opens a new fax data and Transaction file for the message if there is no current queue for that destination machine, or it prepares to append the data to an existing queue 137. The various call and file parameters are linked and stored 138 and the call parameters are passed through 139 to the Local Interface 83, which then decides 141 whether the call is addressed to a "real" fax number, or a fictitious number terminating in a mail box. If the number is real the Local Interface attempts to contact the destination machine for immediate delivery.

The Host then enters a loop where it gets the incoming data 147, stores it 148 in the fax Delivery Queue, and passes it through 149 to the Local Interface buffer. When the Host determines that the fax transfer is complete 150, it then checks 152 (Figure 6b) to see if the Local Interface has been able to make immediate delivery. If it has, the Host initiates the transmission of the Delivery Report 167 back through its Status and Control Interface 84 to the System Control and Status unit 11, which in turn updates the Transaction File and sends it back to the originator SAFF over Trunk 15. It is this communication which ultimately results in the immediate Delivery Report described previously. The transaction is then terminated 169.

If immediate connect is not established a Retry Report is sent 153 back through the System Status and Control unit and the Retry sequence begins. The Retry criteria can be varied

154, both in place and with the SAFF setting. For example, if the SAFF is integrated into a local exchange, the SAFF can actually monitor the desired line and simply wait for it to become available. In other settings it will be necessary for the SAFF to actually redial at prescribed intervals. In any case attempts to connect are made 155 and if they are not successful 156 a counter or timer is checked 159 to see if the retry limit has been exceeded. If not, the process is repeated and if so, a Failed Delivery Report 160 is sent back through the system and the effort terminated 170.

If the retry effort is successful the Delivery Queue is retrieved 158 and message by message 162 the queue is dumped, with a pause 163 after each message to confirm receipt, send a Delivery Report 164 and to check for end of queue 165. If a message fails during the queue dump the retry sequence at 154 is resumed at the failure point and the process repeated to a conclusion. When the last message has been received satisfactorily, the transaction is terminated 168.

If it is determined at 141 (Figure 6a) that this is a mail box call, a loop is entered which gets the fax data 142 and stores it 143 in the appropriate Mail Box Queue. When the end of message is detected 144, a Posting Report 145 is sent back through the system and a Message Waiting Report 146 is sent forward through the system to the default destination machine.

General Service calls always arrive on Ordinary Local Lines 5. Upon detection and answering 172, the voice response menu is presented 173 to the user. As with the Mail Box Service, the user keys in responses or gives them orally 174 and a decision ladder 175 identifies the desired service routine such as 177, 178, or 179. Here again only a few of the possible choices have been shown for sake of illustration and looping for multiple service requests is provided. The selected service routine generates command parameters which are parsed 181 as system commands and sent 182 to the System Status and Control unit 11 for execution. Upon completion of all requests the call is terminated 183.

What has been described are the presently preferred embodiments of a system and method for providing a comprehensive interactive facsimile message management system embedded in a switched telephone network. It should be apparent that many modifications to the system and the method are possible without departing from the true spirit and scope of the invention.

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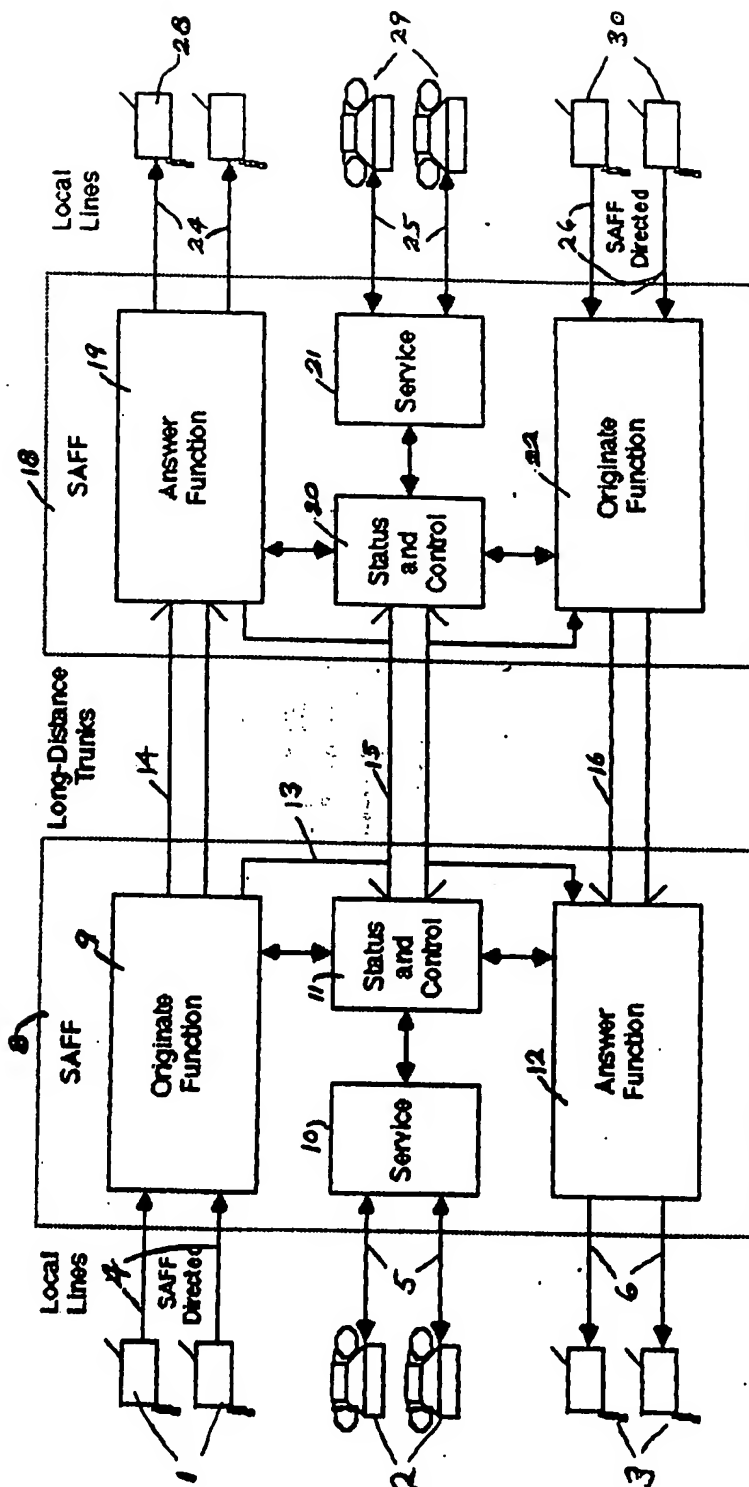


Fig. 1

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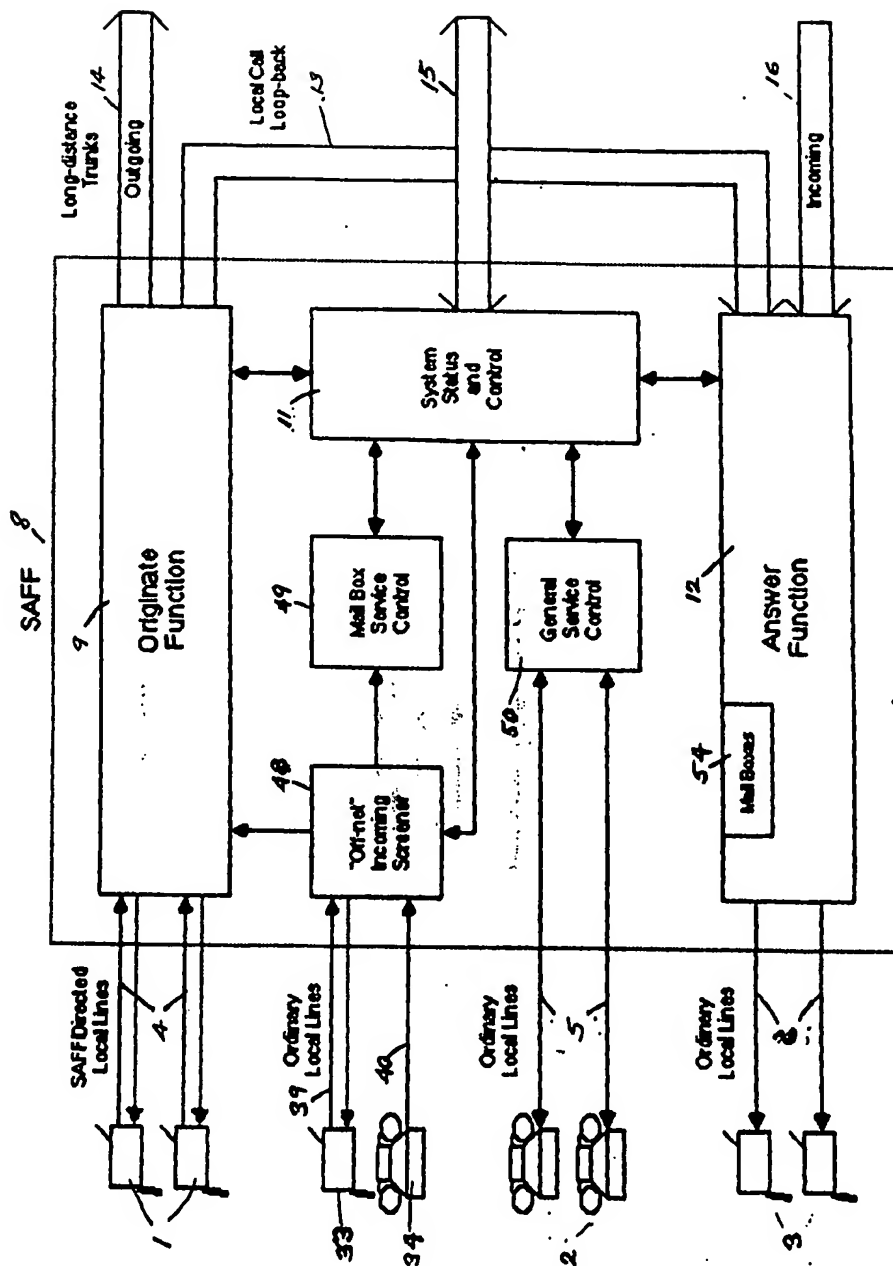


Fig. 2

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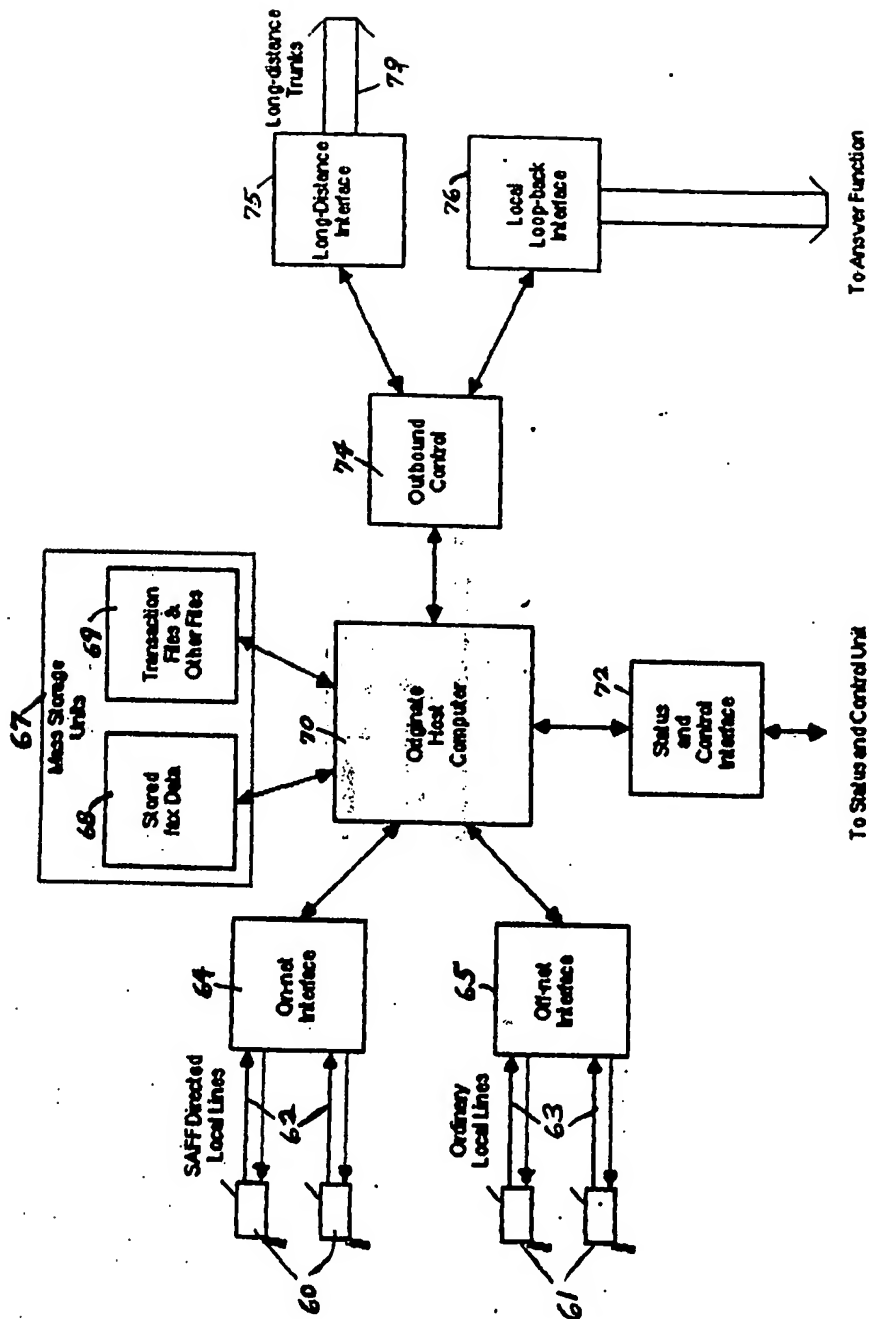


Fig. 3

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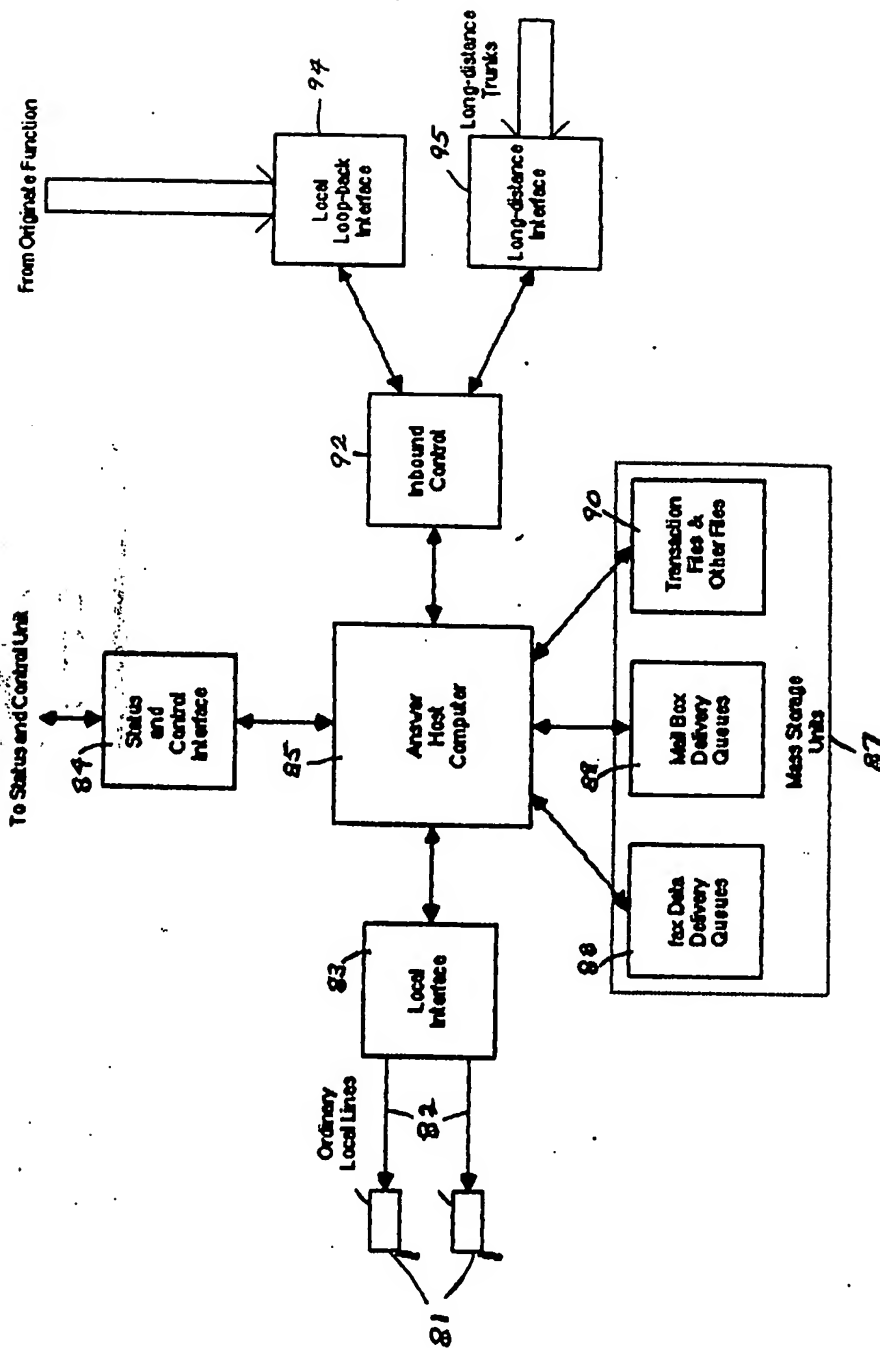


Fig. 4

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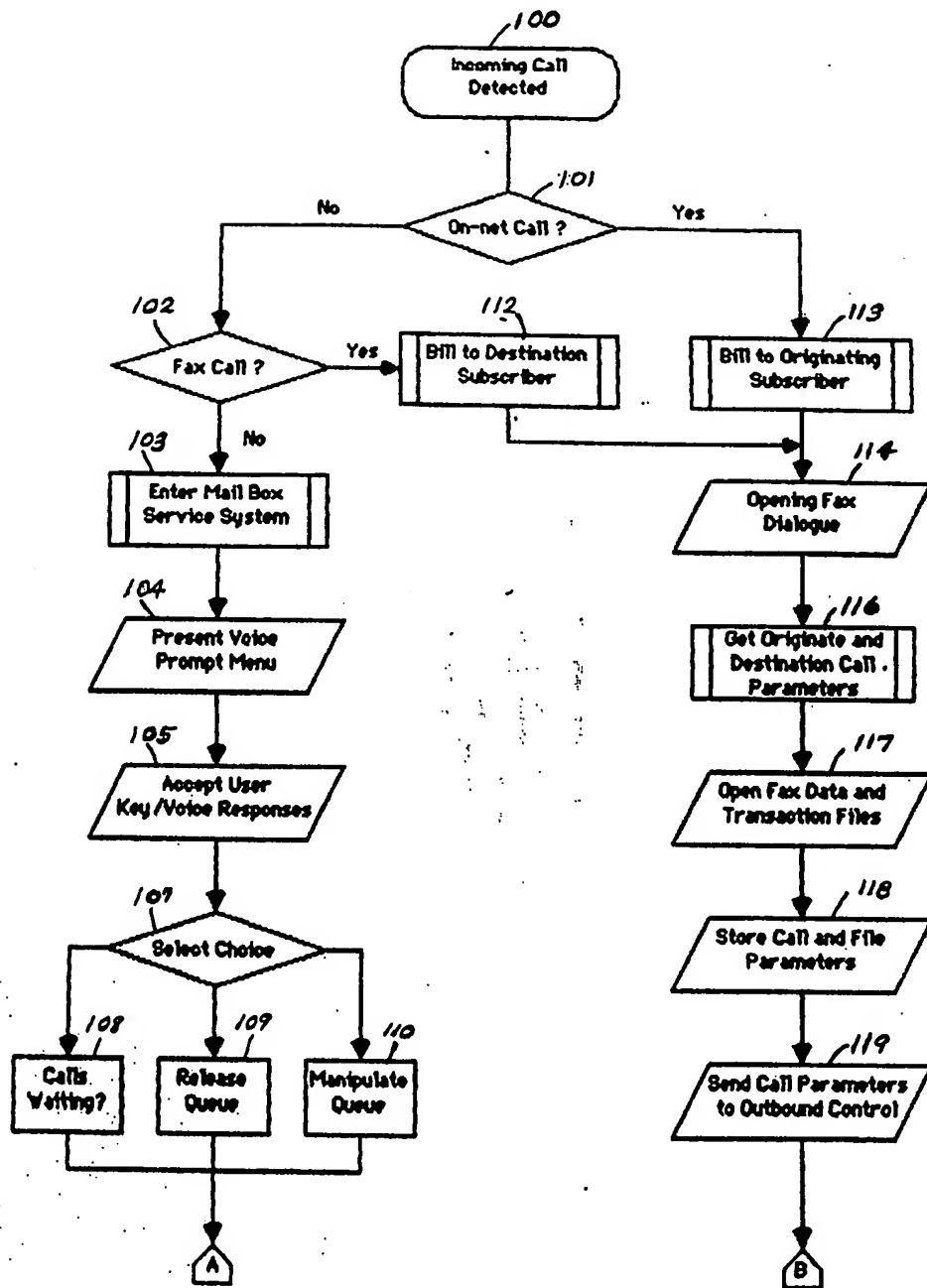


Fig. 5a

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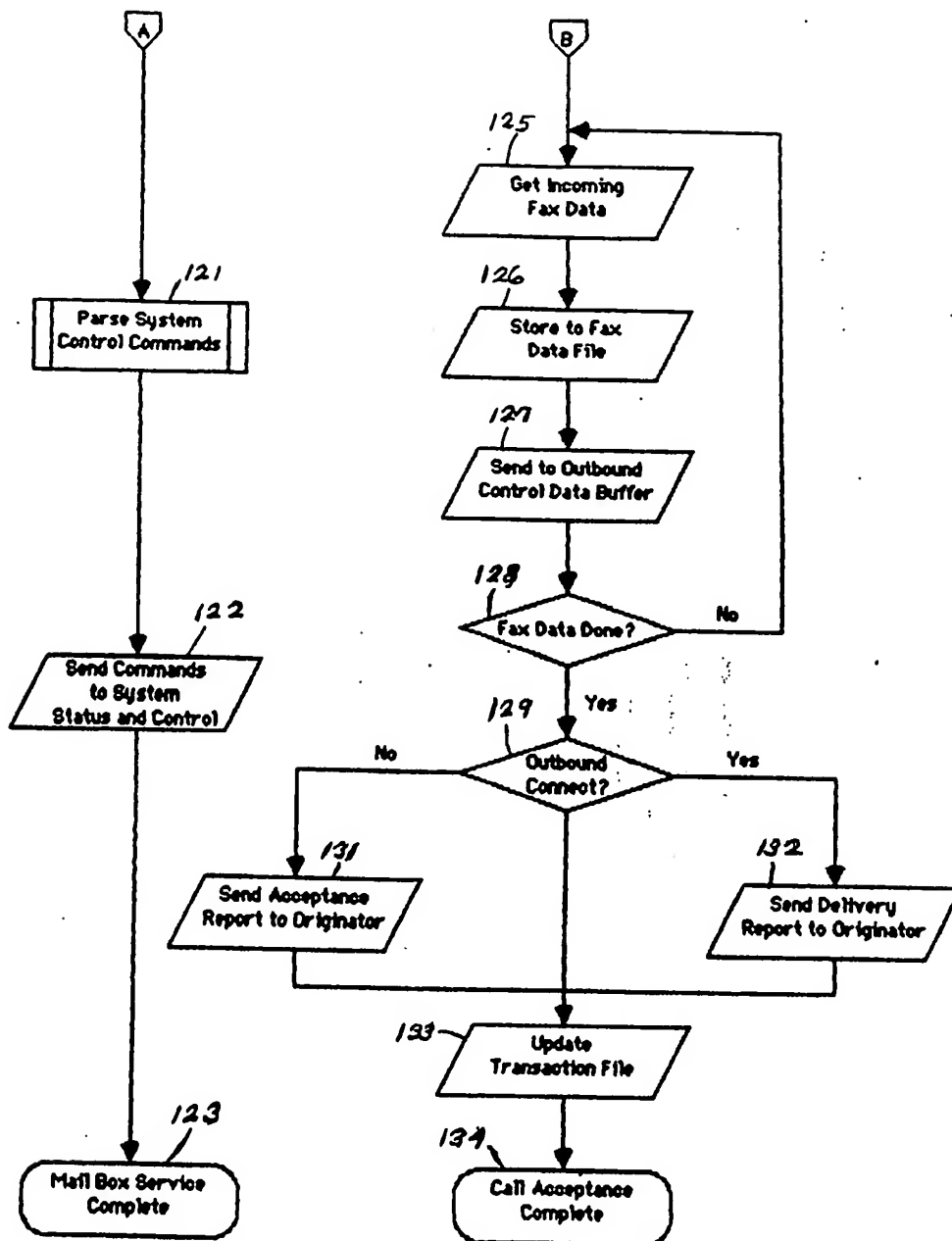


Fig. 5b

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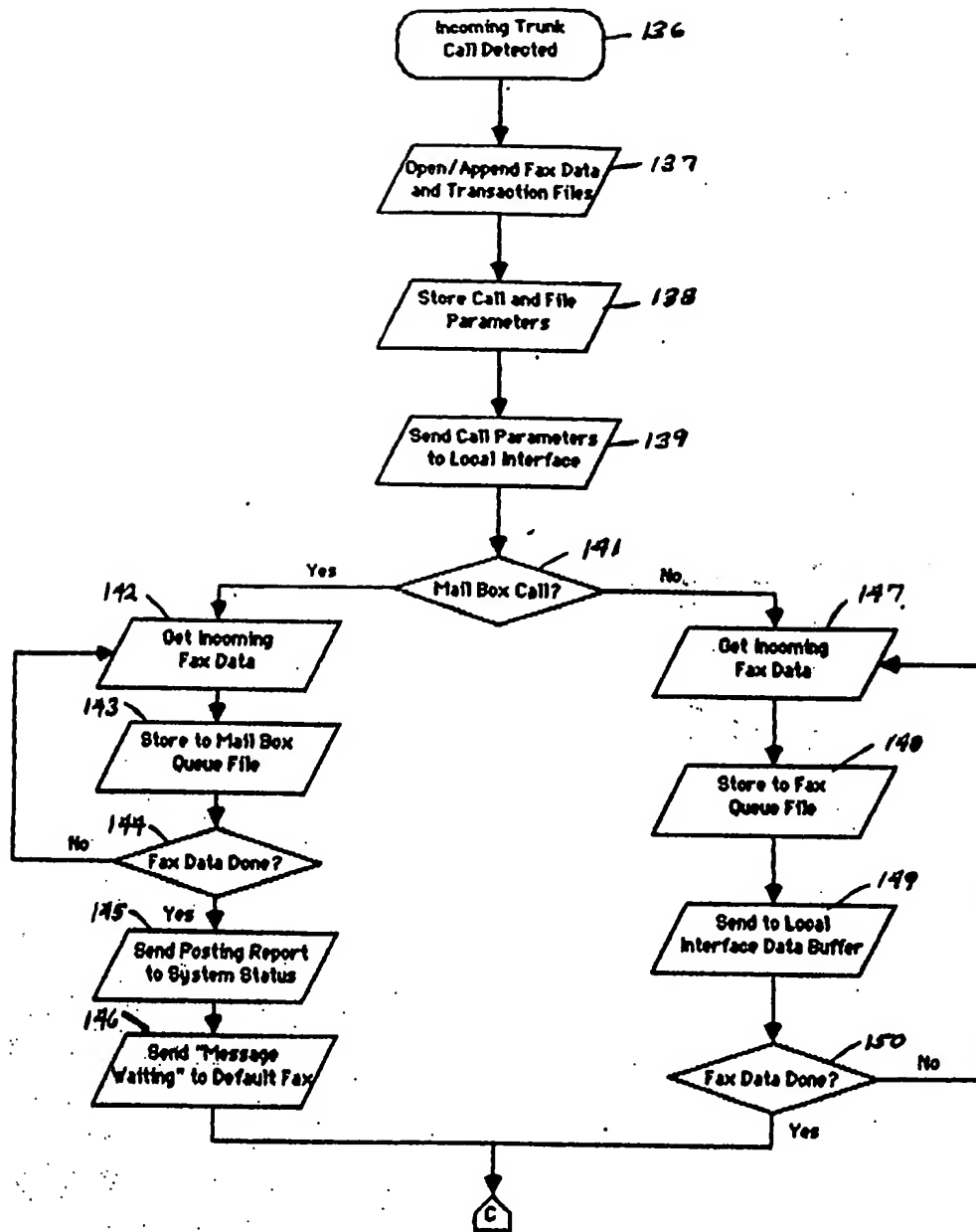


Fig. 6a

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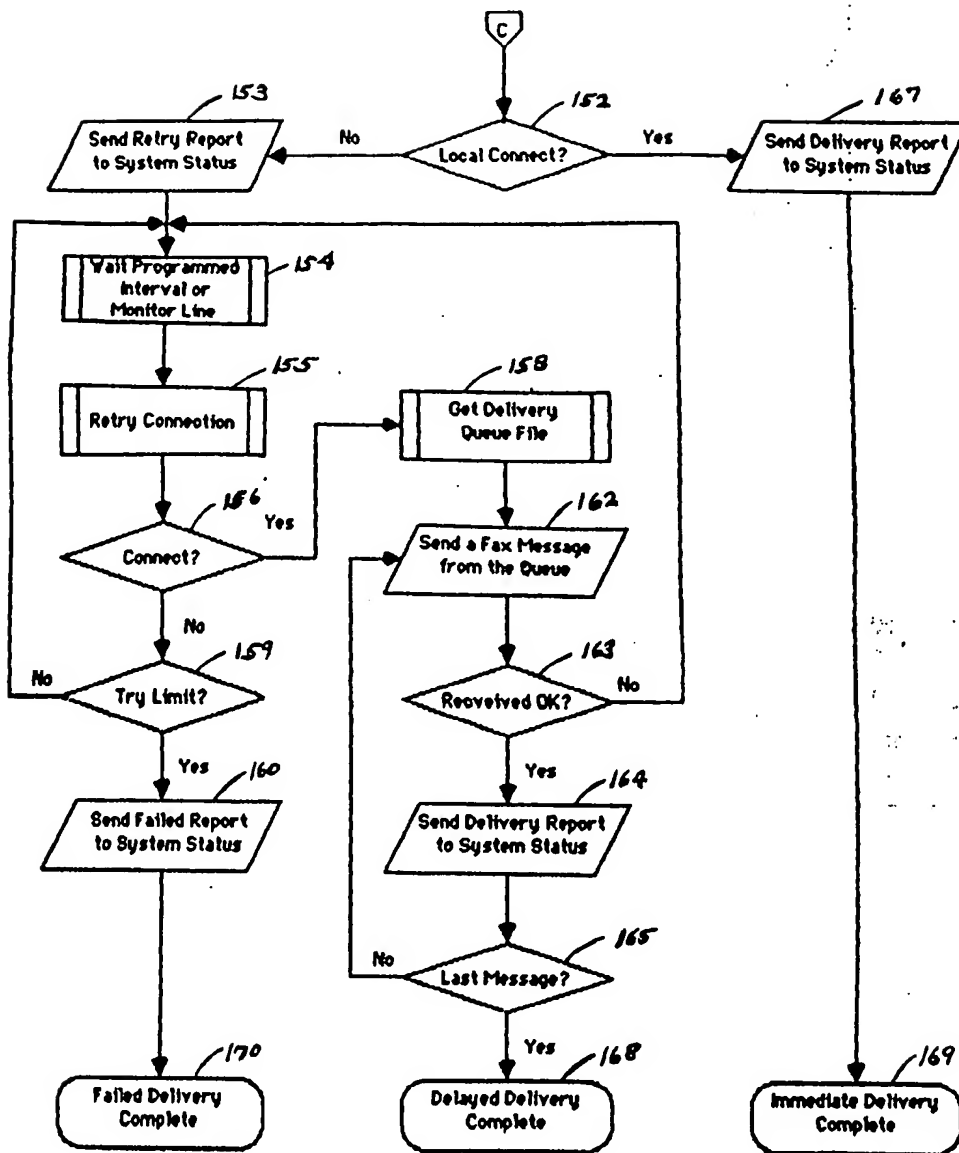


Fig. 6b

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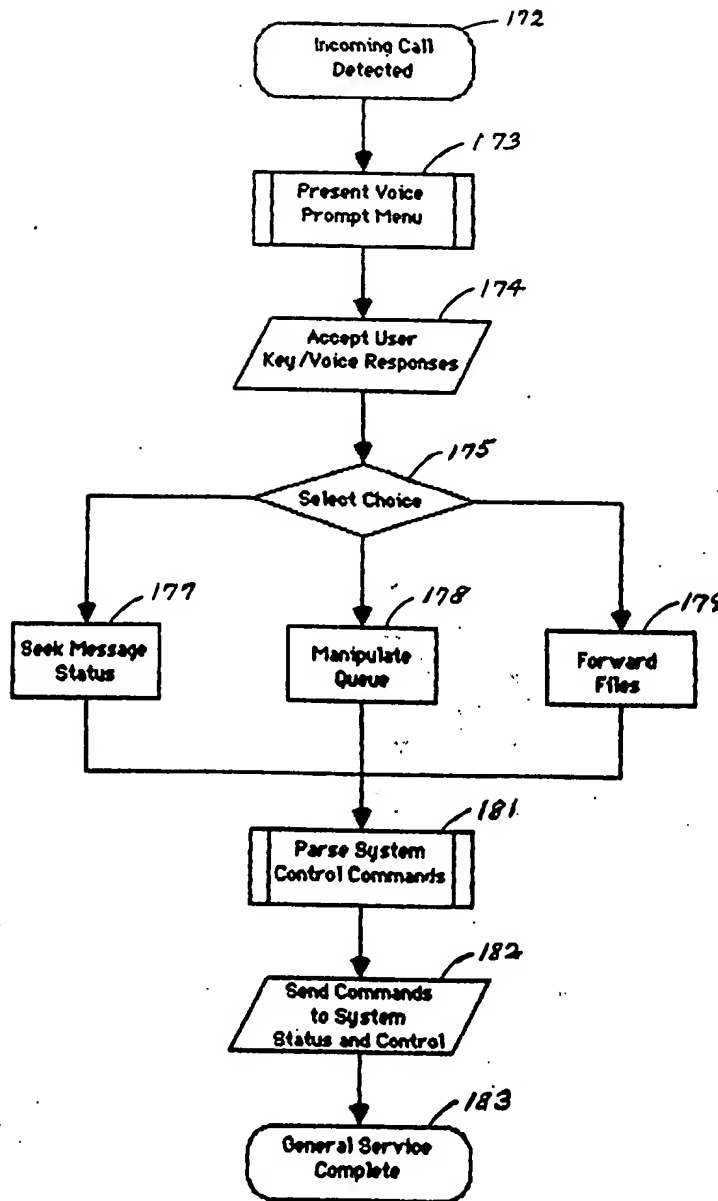


Fig. 7

Gouling, Strathy & Henderson

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